NJ Department of Environmental Protection
Water Monitoring and Standards

Reappraisal Report for Shellfish Growing Area A0NorthCent (Bayhead to Monmouth Beach)

April 2013

State of New Jersey
Chris Christie, Governor
Kim Guadagno, Lt. Governor

NJ Department of Environmental Protection
Bob Martin, Commissioner

Reappraisal Report for Shellfish Growing Area A0NorthCent (Bayhead to Monmouth Beach)

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April 2013

2008 - 2012

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Cover Photo – Lake Takanassee – After Sandy - Ocean Avenue, Long Branch, NJ

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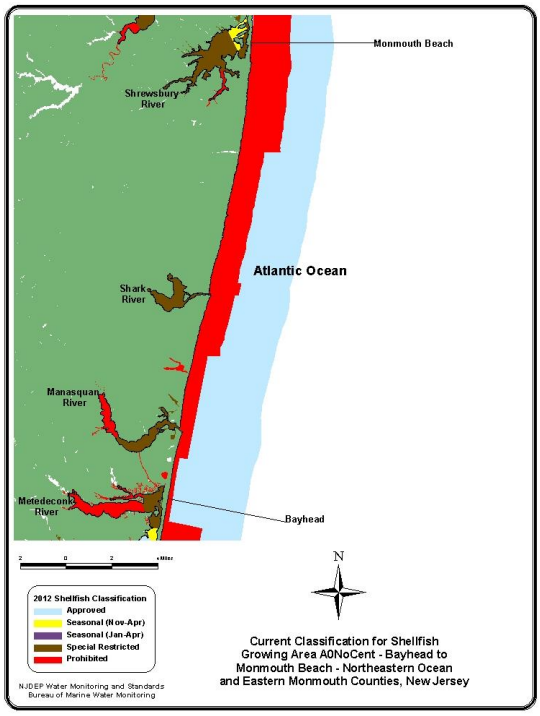
EXECUTIVE SUMMARY

For this Reappraisal, the results of water quality analyses for samples collected between May 2008 and October 2012 for Shellfish Growing Area A0NorthCent – Bayhead to Monmouth Beach (A0NorthCent) suggest National Shellfish Sanitation Program (NSSP) classification criteria were satisfied in all cases with the exception of *Approved* bottom station A20B (A - B). Station A20B (A - B) exceeded NSSP *Approved* year round and summer criteria. The data for this station was generally acceptable with the exception of three sample dates (two in 2009 and one in 2011). All Bacteriological counts since that date have been very low (i.e., 3.0 k or less than three on each of six sample dates) and within the *Approved* criteria. WM&S/BMWM will continue to utilize a frequent review process for potentially higher counts in the raw data for this station going forward, and this will be noted in the Recommendations section. A discussion of bacteriological results for all stations in this shellfish growing area including A20B (A - B) can be can be found in the section entitled Bacteriological Quality that follows later in this report.

A0NorthCent is an ocean shellfish growing area that encompasses 18 miles of coastline from Bayhead in the south to Monmouth Beach in the north. This growing area then extends eastward from the coast out into the Atlantic Ocean for three miles. In total, A0NorthCent is currently comprised of 46,664 acres of shellfish growing waters.



The criteria used for shellfish growing water classification review in this Reappraisal is based on *Approved* or *Prohibited* water classifications as shown in the figure to the right, as these are the only two classifications used for New Jersey's ocean shellfish growing waters. Currently, there are 31,985 acres of *Approved* waters in A0NorthCent and 14,679 acres are designated as *Prohibited*. The New Jersey Shellfish Growing Water Classification Charts for 2012 provide an excellent tool for viewing the location and classifications for A0NorthCent (see charts 3 – 5 at www.state.nj.us/dep/wms/bmw).

The discharge pipes and outfalls of six wastewater treatment facilities are located within A0NorthCent. From south to north, these facilities are the South Monmouth Regional Sewerage Authority, Township of Neptune Sewerage Authority, Asbury Park Water Pollution Control Facility, Township of Ocean Sewerage Authority, Long Branch Sewerage Authority and the Two Rivers Water Reclamation Authority.

The treatment plants and their outfalls warrant description due to their location and potential to contribute influence as direct source inputs. Wastewater treatment plant outfalls require the designation of safety zones or *Prohibited* areas that act as buffers for dilution. These buffers are

a necessary precaution in terms of public health concern and potential impact due to incidental or accidental effluent discharge of untreated sewerage.

NSSP also requires the use of Adverse Pollution Condition (APC) sampling strategy in shellfish growing areas where direct discharge from wastewater treatment facility effluent outfalls could potentially impact the water quality with increased bacterial contamination. During the time frame that this report was written, there were no ongoing impacts to the waters of A0NorthCent from treatment plant error, operations, or direct discharge. Continuous upgrades have helped the wastewater treatment facilities noted on the previous page, continue operations in an efficient and reliable fashion. This in turn helps improve water quality for this shellfish growing area.

Non-point source inputs such as those that might emanate from stormwater outfalls are located within some ocean waters of A0NorthCent, and certain brooks and rivers that feed into these waters receive such inputs. *Prohibited* waters blanket the entire coastline of this shellfish growing area and as such, surround the stormwater outfalls and mouths of the brooks and rivers that provide non-point inputs. No ongoing, debilitating impact from these sources has been noted for A0NorthCent. Stormwater inputs from the outfalls, brooks, and rivers noted above have generally been diluted before they meet and mix with ocean waters, and further dilution takes place as they mix with the Atlantic. As such, inputs from indirect sources appear to have limited effect on this growing area and its *Approved* waters.

The presence of generally acceptable data from the monitoring and analysis presented in this report supports the current classifications designated for A0NorthCent. With this in mind, there are no adjustments recommended for assignments, stations, monitoring, or sampling for this reporting period with the exception that routine monitoring of incoming data for station A20B (A - B) should continue.

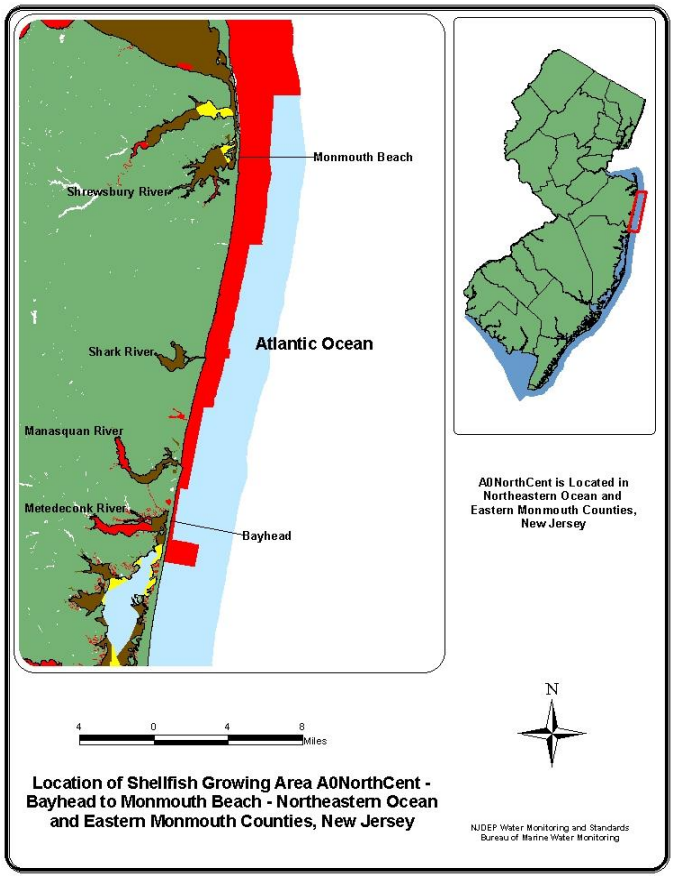
GROWING AREA PROFILE

LOCATION AND DESCRIPTION

This Reappraisal covers the ocean shellfish growing waters from Bayhead in the south to Monmouth Beach in the north (see figure on the next page), and offshore to the State's three (3) mile jurisdictional limit (Please Note: all references to "miles" in this report are in nautical measure, whereby, one Nautical Mile equates to 6,086 feet).

The numerous coastal towns adjoining the shellfish growing waters of A0NorthCent are urban, comprised in large part by residential homes although there are clusters of commercial properties. These towns generally act as seashore towns with populations expanding during spring and summer and substantially reducing in the winter.

A0NorthCent shellfish growing waters receive input from the Manasquan and Shark Rivers along with Poplar Brook and Whale Pond Brook (indirectly – feeds into Lake Takanassee, which has an ocean outfall). There are a number of stormwater outfalls within those water sources and stormwater outfalls exist within various inshore lakes and ponds that empty into the waters of this growing area, and along the A0NorthCent shoreline. In addition, there are six wastewater treatment facilities servicing the coastal towns of A0NorthCent with direct outfalls within A0NorthCent shellfish growing waters.



As mentioned in the Executive Summary, there are six wastewater treatment facility discharge pipes and outfalls located in the waters of A0NorthCent. The six treatment facilities associated with these discharge pipes and outfalls service the shoreline communities abutting this shellfish growing area. Former reports for A0NorthCent have found these wastewater treatment plant outfalls were the only direct point sources of pollution identified that had the potential to impact this locations water quality.

Yearly data listings have shown the effluent from these ocean discharge locations has not had a significant or ongoing impact to the water quality or classifications of this shellfish growing area. None the less, closed safety zones or *Prohibited* waters surrounding these direct outfalls must continue to be maintained in order to provide buffers for public health and safety.

Rainfall runoff also appears to have limited impact on this area's current shellfish classifications. Generally, impacted waters from stormwater runoff receive substantial dilution and mixing before entering the ocean. Dilution occurs to such inputs before they make their way to those areas where classifications prevail for *Approved* shellfishing, as mixing occurs in the rivers, brooks, lakes, and ponds, and additionally there is a *Prohibited* buffer along the entire shoreline of A0NorthCent providing dilution to impacted waters.

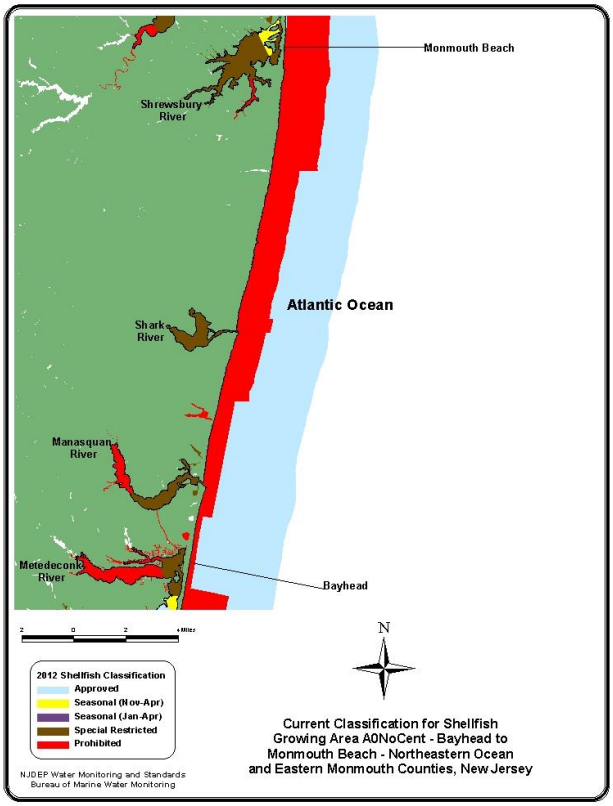
GROWING AREA CLASSIFICATION SUMMARY

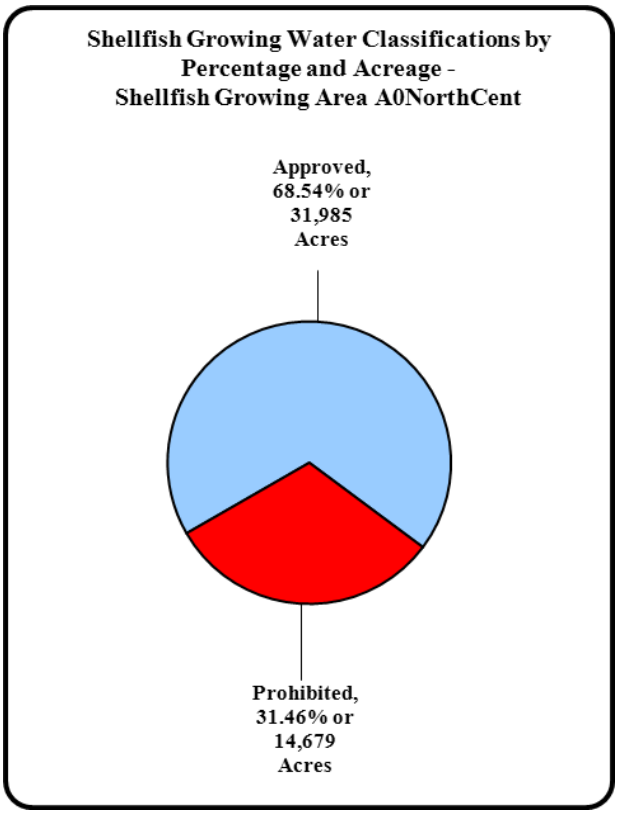
The last Sanitary Survey, and last report for the waters of A0NorthCent was written in 2011, and comprised of data from 2005 - 2010. In that report, A0NorthCent was reported to consist of 46,664 acres with 31,985 acres of *Approved* and 14,679 acres of *Prohibited* waters. The representative data presented for that reporting period (05/01/05 – 04/13/10) suggested that bacteriological water quality for fecal coliform in A0NorthCent was generally acceptable with regard to classifications associated with these waters. Continued observation for *Approved*

surface station A16A2 was recommended though, due to an individual occasion in 2005 and again in 2006, where two higher raw data scores were observed for that station during the summer. Subsequent data for this station has been within the criteria for *Approved* classification.

This report will serve to support all classifications and classification acreage presented in the 2011 Sanitary Survey with no changes recommended at this time. Again, as noted in the Executive Summary, *Approved* bottom station A20B (A - B) exceeded NSSP *Approved* year round and summer criteria. The data for this station was generally acceptable with the exception of three sample dates (two in 2009 and one in 2011). All Bacteriological counts since that date have been very low.

The information contained within this Reappraisal (2008 – 2012) suggests classifications, stations, monitoring, and sampling strategy should remain unchanged as the data suggest there is no current need for adjustment. Current classifications along with growing water acreage and percentages are shown below.





EVALUATION OF BIOLOGICAL RESOURCES

Historically, *Approved* ocean waters have been used for harvesting surf clams (Spisula solidissima) and blue mussels (Mytilus edulis) by dredge boats licensed by the Division of Fish and Wildlife. Surf clams (for bait purposes only - non-human consumption) can also be harvested from *Prohibited* areas under a special program administered by WM&S/BMWM and enforced by the Division of Fish and Wildlife.

In addition to being the State's largest molluscan fishery (i.e., regarding lbs. landed), New Jersey's surf clam fishery historically leads all other surf clamming states in total annual landings, and continues to do so according to the most recently released statistics from NOAA's National Marine Fisheries Service. The table below denotes commercial landings in pounds of meat and ex-vessel value for New Jersey surf clams from 1993 through 2011. Additionally, figures for 2012 had not been verified and posted at the time this Reappraisal was written.

Commercial Data for Surf Clams Showing Pounds of Meat and Ex-vessel Value for New Jersey Landings.
Source: NOAA - National Marine Fisheries Service – February 27, 2013

Year	Lbs. of Surf Clams Landed	Ex-vessel Value
1993	47,978,097	$ 21,802,735
1994	48,572,236	$ 26,840,477
1995	46,329,437	$ 27,443,281
1996	48,740,881	$ 28,983,170
1997	45,603,401	$ 27,168,453
1998	44,751,327	$ 23,060,750
1999	49,299,900	$ 25,371,922
2000	58,047,629	$ 31,371,354
2001	52,872,341	$ 29,326,676
2002	53,590,740	$ 29,172,373
2003	51,336,955	$ 27,431,645
2004	43,521,704	$ 22,284,335
2005	38,967,993	$ 20,028,662
2006	43,643,726	$ 25,106,785
2007	44,791,212	$ 26,546,602
2008	39,346,425	$ 24,349,551
2009	32,893,521	$ 20,568,576
2010	25,089,484	$ 16,010,934
2011	16,930,215	$ 10,980,834

At the time this report was written, the National Marine Fisheries Service reported the primary biological resources of commercial importance in pounds of meat landed and dollar value for New Jersey waters from 0 – 3 miles [w/in the State's three (3) mile jurisdictional limit] were Black Sea Bass, Bluefish, Common Eels, Croaker, Dogfish Sharks, Goosefish/Anglerfish, Menhaden, Skates, Summer Fluke, Blue Claw Crabs, Conch, Ocean Quahogs, Sea Scallops, and Surf Clams.

From three to two hundred miles out, the market species sought after by New Jersey fishermen (in terms of pounds of meat landed and dollar value) were the Albacore Tuna, Atlantic Mackerel, Atlantic Sea Herring, Bigeye Tuna, Black Sea Bass, Bluefin Tuna, Bluefish, Butterfish, Chub Mackerel, Croaker, Dogfish Shark, Dolphinfish, Goosefish/Anglerfish, Red Hake, Scup/Porgy, Silver Hake, Skates, Summer Fluke, Swordfish, Tilefish, Yellowfin Tuna, American Lobster, Atlantic Squid, Jonah Crab, Ocean Quahog, Sea Scallops and Surf Clams.

In terms of pounds landed for New Jersey species, Menhaden totals surpass all others for this reporting period. For State shellfish, surf clam totals are the largest, and for the shellfish growing water classification purposes of this report, surf clams as a shellfish and by number of pounds landed will remain the primary focus.

Since New Jersey's surf clam industry is at the national forefront in total landings, monitoring, management, and conservation of this resource is very important to the State. In this regard, the New Jersey Surf Clam Advisory Committee, comprised of industry and government representatives, in conjunction with the Commissioner for the New Jersey Department of Environmental Protection, sets the quotas for harvest. A brief history of those quotas and the ocean bi-valves with the largest landings for the State are shown in the tables that follow.

New Jersey Surf Clam Quotas in Industry Bushels by Year (1996 – 2013). Source: New Jersey Department of Environmental Protection, Bureau of Shellfisheries

Surf Clam Harvest Year	Surf Clam Quotas in Industry Bushels
1996 - 1997	600,000
1997 - 1998	600,000
1998 - 1999	700,000
1999 - 2000	700,000
2000 - 2001	700,000
2001 - 2002	600,000
2002 - 2003	600,000
2003 - 2004	275,000
2004 - 2005	350,000
2005 - 2006	237,000
2006 - 2007	240,000
2007 - 2008	198,000
2008 - 2009	58,368
2009 - 2010	55,296
2010 - 2011	55,296
2011 - 2012	49,152
2012 - 2013	24,576

Ocean Bi-Valves w/ Largest Landings Reported for New Jersey (0 - 3 Miles Distance from Shore highlighted in yellow)

	DISTANCE FROM N. J. SHORE								
	0 - 3 MILES		3 - 200 MILES		HIGH SEAS		COMBINED TOTALS		
COMMON BI-VALVE NAME	Pounds of Meat (000)	Dollars (000)	Pounds of Meat (000)	Dollars (000)	Pounds of Meat (000)	Dollars (000)	Total Pounds of Meat (000)	Total Dollars (000)	Price/ Pound of Meat
Surf Clam	7,959	4,641	17,130	11,370	-	-	25,089	16,011	$.64
Sea Scallops	56	497	14,098	108,492	-	-	14,155	108,990	$7.70
Ocean Quahog	2,141	1,104	11,307	6,775	-	-	13,448	7,878	$.59
-- TOTALS --	10,156	6,242	42,535	126,637	-	-	52,692	132,879	

Adapted from: Landings by Distance from U.S. Shores, 2010, State of New Jersey, National Marine Fisheries Service - Fisheries Statistics and Economics Division - Report printed on: 02/27/13
*** No Data Available**

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Shoreline surveys or site specific tours of areas nearby or abutting shellfish growing waters can provide insight as to the location and nature of land use, surface water discharges, marinas, unpermitted discharges, and stormwater inputs. A shoreline survey of A0NorthCent was conducted on April 11, 2013, and the following sections detail information derived collectively from that survey, and those that preceded it.

LAND USE

Areas for new development are generally limited within the municipalities or boroughs abutting A0NorthCent as much of the land that could be used for such projects has already been developed. Under normal circumstances there would be some new construction projects taking place in areas where homes had been torn down. And, there might be some new home projects taking place on previously vacant land. In addition, many of the homes and businesses within coastal A0NorthCent do undergo reconstruction and refurbishment from time to time.

The post Hurricane Sandy shoreline survey that was undertaken on 04/11/13 presented a great deal of interior and exterior damage to homes and businesses within the communities that abut the shellfish growing waters of A0NorthCent. In particular, the communities of Point Pleasant Beach Boro, Manasquan, and Belmar had numerous homes that received a great deal of damage. Much of the damage in these sectors was the result of the large volume of sand and water that swept through real estate as it moved from the ocean to the bay. With Hurricane Sandy, storm surge factors in the ocean presented the greatest destructive force for homes and businesses in shellfish growing area A0NorthCent. In addition, the inlet sectors of the Manasquan River and Shark River were particularly damaged in the towns of Manasquan and Belmar, with respect to their locations along those rivers and inlets.

It was additionally obvious that the inter – coastal lakes that parallel the A0NorthCent coastline had substantial flooding. In particular, Deal Lake and Lake Como showed signs that the ocean had breached or cut through to these lakes, which in turn caused substantial damage to surrounding homes and infrastructure.

Marinas and smaller boat dockage areas in all sectors of A0NorthCent showed signs of Hurricane Sandy's damage during the 04/11/13 shoreline survey. Although numerous docks had been lifted by the force of the storm and many top deck boards were missing or being repaired, most marinas throughout the area seemed to be near ready to open or already open for the coming season.

During the 04/11/13 shoreline survey, particular attention was paid to the condition of stormwater outfalls and their surroundings. In general, all outfalls visited appeared clear of debris, and if debris was present, it was located in limited quantities within areas near the outfalls. Little damage to stormwater outfalls was observed, and where damage had occurred, repairs had been done or were being done. In particular, damage to stormwater outfalls was observed in Deal but repairs were underway.

As with any significant storm, construction to repair damages will occur. It is important to note at this time that impact from construction is lessoned or unlikely though due to the nature of the land and water abutting and surrounding this shellfish growing area. Construction projects bordering on eco-sensitive areas such as those in A0NorthCent are required by local, state, and federal regulations to utilize specific setbacks and buffers as a means of protecting flora and fauna specific to wetland, riparian, or estuarine locations. The use of these buffers can never be understated as their utilization suggests construction is unlikely to severely impact surrounding natural ecosystems.

Aside from contributing to productivity, wetland and estuarine zones provide valuable habitat for many marine species during some point of their life cycle. In addition, some plant species within these zones take up contaminants from the ecosystem.

A limited area of wetlands is present in close proximity to urban development in A0NorthCent. Locations for these wetlands can be seen in the figure for land use at the end of this section. The most notable wetland location is situated in the western portion of the Manasquan River. There are additional wetlands scattered between the Shark and Shrewsbury Rivers.

The land adjacent to A0NorthCent is typical of New Jersey's coastal geophysiology. The Atlantic Ocean is located to the east. The predominant land use is urban. Interactions of ocean tides and wind help shape the shore and dune line along the easterly confines of A0NorthCent. There is influence from the rivers and brooks that directly empty into this growing area or indirectly flow (i.e., Whale Pond Brook). The largest of these water sources, and those that exhibit the greatest influence on A0NorthCent waters are the Manasquan River that feeds into the southern portion of A0NorthCent and Shark River, which empties into this growing area in the south central section.

There are numerous mainland communities situated west of A0NorthCent (see municipality figure at end of this section). These communities can provide a source of nutrient and bacterial loading when considering the numerous stormwater inputs and outfalls that flow into or toward the ocean waters of A0NorthCent. However, the distance from input sources to the *Approved* waters of this growing area provides substantial time and area for dilution. In addition, WM&S/BMWM water quality testing shows that they have minimal impact on the current classification of shellfish growing waters for A0NorthCent.

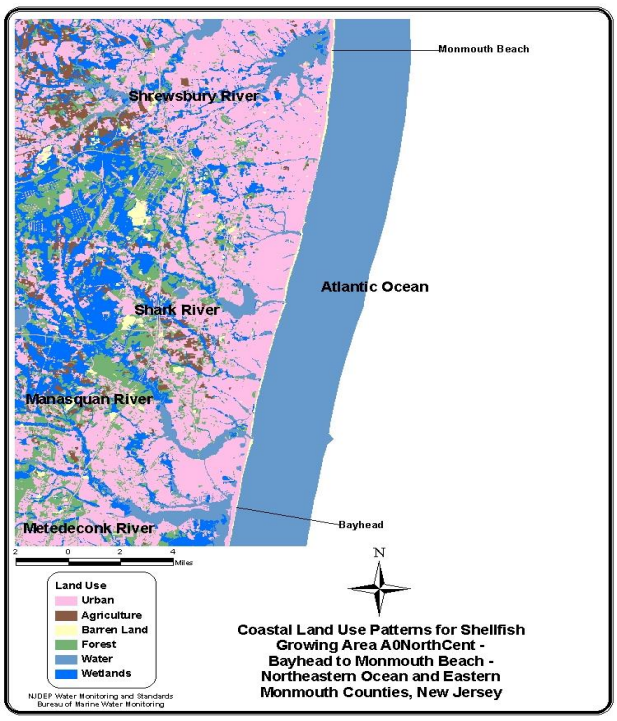
Sewage from municipalities within close proximity to A0NorthCent is carried to wastewater treatment facilities by sanitary sewers. It is treated by one of the six facilities mentioned in the Executive Summary.

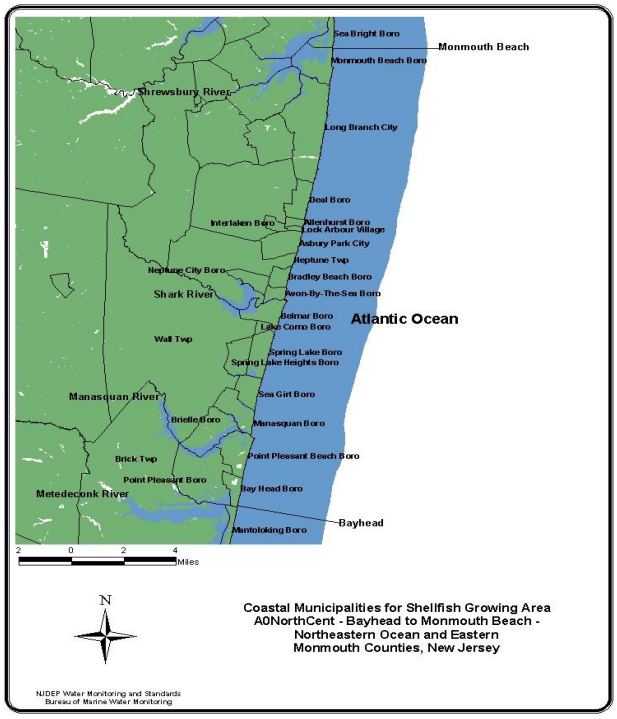
There are pockets of homes well to the west of shellfish growing area A0NorthCent that utilize septic systems. Septic is primarily utilized in areas of lower population density. Generally, the availability for access to city sewage infrastructure is less likely in these areas.

There are always concerns regarding nutrient loading and elevated coliform levels in watersheds near communities utilizing septic. However, the distance from these communities to this growing area provides a safety zone for dilution.

Further, as populations grow and communities expand, this generally leads to the extension and availability of city sewer lines to homes.

Sewerage treatment plants are generally designed or have been upgraded to facilitate population growth or seasonal fluctuation. Seasonal fluctuation with regard to capacity loading (for treatment plants) is especially important within New Jersey's coastal communities as per increased use during the summer.





SURFACE WATER DISCHARGES – TREATMENT FACILITY WASTEWATER EFFLUENTS

Evaluation and compliance of shellfish growing areas is ascertained using NSSP criteria as contained in the *Guide for the Control of Molluscan Shellfish*, 2009. Interaction between the State and treatment plants is important in determining plant efficiency, which integrally relates to the eventual effluent quality discharged into ocean waters off the coast of New Jersey. State effluent standards for direct discharge are presented in the table on the following page. And, the wastewater treatment facilities, discussed in this section do maintain the standards shown in that table.

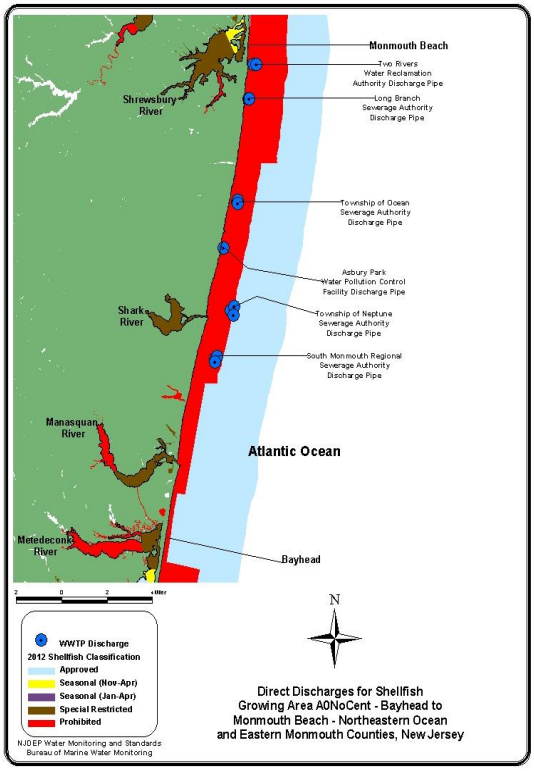
As previously mentioned in this report, there are six wastewater treatment facility discharge pipes and outfalls located within A0NorthCent, which represent potential point sources of contamination. From south to north, they are the South Monmouth Regional Sewerage Authority (SMRSA), Township of Neptune Sewerage Authority (TNSA), Asbury Park Water Pollution Control Facility (APWPCF), Township of Ocean Sewerage Authority (TOSA), Long Branch Sewerage Authority (LBSA), and the Two Rivers Water Reclamation Authority (TRWRA).

Effluent Standards for Direct Discharge to Surface Water from Publicly/Privately Owned Wastewater Treatment Facilities – NJPDES Permit Regulations (7:14A – 12.2 – 12.5)	
Avg. BOD_5 Level/Wk.	**≤ 45 mg/L**
Avg. BOD_5 Level/Mo.	**≤ 30 mg/L**
Avg. BOD5 % Removal/ Mo.	**≥ 85%**
or Avg. CBOD5 Level/Wk.	**≤ 40 mg/L**
or Avg. CBOD5 Level/Mo.	**≤ 25 mg/L**
or Avg. CBOD5 % Removal/ Mo.	**≥ 85%**
Avg. TSS Level/Wk.	**≤ 45 mg/L**
Avg. TSS Level/Mo.	**≤ 30 mg/L**
Avg. TSS % Removal/ Mo.	**≥ 85%**
Geo. Mean FC/Wk.	**≤ 400 MPN/100 mL**
Geo. Mean FC/Mo.	**≤ 200 MPN/100 mL**

All of the wastewater treatment plant outfalls mentioned in the following sections are located in the Atlantic Ocean, east of Monmouth County. With the exception of the Township of Neptune Sewerage Authority, which uses tertiary treatment, wastewater facilities discussed within this report utilize secondary forms of sewage treatment. All facilities eventually release treated effluents through their ocean outfalls.

To allow for additional mixing and dilution, these ocean outfalls are located at some distance offshore. In nautical miles, the approximate distances are as follows: SMRSA (.73 n mi.), TNSA (.95 n mi.), APWPCF (.14 n mi.), TOSA (.33 n mi.), LBSA (.20 n mi.), and TRWRA (.27 n mi.).

The South Monmouth Regional Sewerage Authority Discharge Pipe and discharge location are situated southeast of Lake Como, Spring Lake Boro. Township of Neptune Sewerage Authority has its discharge pipe and discharge location running east of the intersection of Ocean and Garfield Avenues in Avon-by-the-Sea Boro. The discharge location and line for Asbury Park's' Water Pollution Control Facility run to the southeast of 8th Avenue, Asbury Park City. The Township of Ocean Sewerage Authority discharge line and outfall location are due east of Poplar Avenue, Deal Boro. The LBSA discharge pipe and outfall are located to the northeast of the intersection of Joline and Ocean Blvd. North, Long Branch. The TRWRA discharge pipe and outfall are situated in the Atlantic, southeast of Sailors Way and Monmouth Beach Borough.



The figure to the right shows the outfall locations and the table on the next page presents a brief description of the waste type, design flow, and discharge

characteristics of each plant. Summaries of the SMRSA, TNSA, APWPCF, TOSA, LBSA, and TRWRA facilities follow that table.

Map Key(s) - Direct Discharge(s) to Waters of Shellfish Growing Area A0NorthCent			
Facility Name	**Waste Type**	**Waste Quantity (Design Flow - MGD)**	**Discharge**
South Monmouth Regional Sewerage Authority	Residential Wastewater Influent	9.1	Secondary Treated Effluent
Township of Neptune Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	8.5	Tertiary Treated Effluent
Asbury Park Water Pollution Control Facility	Residential Wastewater Influent w/ Light Industrial Input	4.4	Secondary Treated Effluent
Township of Ocean Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	7.5	Secondary Treated Effluent
Long Branch Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	5.4	Secondary Treated Effluent
Two Rivers Water Reclamation Authority	Residential Wastewater Influent w/ Light Industrial Input	13.83	Secondary Treated Effluent

South Monmouth Regional Sewerage Authority

The South Monmouth Regional Sewerage Authority is located at 1235 18th Avenue in Belmar, New Jersey. The plant went online around 1977. It utilizes trickling filters in order to provide secondary treatment to sewage from Brielle, Wall Township, Manasquan, Sea Girt, Spring Lake Heights, Spring Lake, Lake Como and Belmar.

The South Monmouth facility was designed to handle 9.1 million gallons of sewage per day. The sewage inflow to this plant is sanitary or residential. There would be extremely limited industrial discharge to the influent that flows in to the South Monmouth Regional Sewerage Authority, if any, according to spokespersons.

The facility has two trickling filters. These filters are made with “Modular Basket Media”, a plastic media that improves $CBOD_5$, removes additional suspended solids, and reduces ammonia and nitrogen content. They utilize what is referred to as serial routing. Serial routing suggests sewage flows through a primary settling tank to the first trickling filter. After the first trickling filter, the sewage flows through an intermediate settling tank and into a second trickling filter. After the second trickling filter, the sewage flows to the final settling tank and then it is chlorinated. Once the effluent is chlorinated, it is held in an aeration pond, and then an equalization pond, before being released to the Atlantic Ocean.

The flow of sewage through the treatment system may be rerouted to allow for maintenance and repair of the facility. When this occurs, the treatment system becomes a single trickling filter with primary and secondary settling tanks.

There are eleven pumping stations connected to this facility. One pumping station is located in each of the following locations: Brielle, Wall, Sea Girt, Wreck Pond, Spring Lake Heights, Lake Como, and Belmar. In addition, two pump stations are present in each of the following municipalities: Manasquan and Spring Lake.

Automatic alarms are online for all pumping stations and the treatment facility as well. Emergencies relating to high water, power failure, and breakdown activate alarms by means of a Supervisory Control and Data Acquisition System (SCADA). Plant processes are also physically inspected every hour, 24 hours a day, as plant personnel are continuously on hand.

Each individual municipality is responsible for the sewer line, which feeds into their respective pumping stations. Until the late 1900's, infiltration and inflow were not important issues for South Monmouth Regional Sewerage Authority. Incoming sewage had consistently been less than the design capacity of the treatment system. As municipal populations increased, extraneous flows have created more demand for the treatment facility.

In order to take on issues with infiltration and inflow, an infiltration and inflow project (i.e., "I and I project") was integrally designed for six of their eight member towns This project was created to prevent stormwater flows into their inflow lines, allowing the facility to maintain compliance with their NJPDES permit requirements.

Disinfection is achieved through continuous chlorination with Sodium Hypochlorite. Three, 3000 - gallon tanks feed sodium hypochlorite, with daily feed rates that range between 90 and 650 gallons of sodium hypochlorite, depending on the time of year. A chlorine alarm system is on line for leakage. No alarms are on line for failure of the chlorination system but the recorder and status of the tank are checked once per hour.

Chlorine residual is monitored with three grab samples per day. Effluent bacterial testing is performed three times per week.

Township of Neptune Sewerage Authority

This facility is located at 634 Old Corlies Avenue in Neptune, New Jersey. The plant utilizes trickling filter and Biofor processes to provide tertiary treatment to sewage from Neptune Township, Neptune City, Bradley Beach, Avon-By-The-Sea, Ocean Grove, portions of Wall Township, and Tinton Falls.

The facility is designed to handle 8.5 million gallons of sewage per day. Plant engineers suggest peak operating capacity is closer to 11.0 MGD. Sewage inflow is primarily residential. There is some light industrial input from a laundry business and plating factory.

Automatic alarms are online for the single pumping station, located on Laird Avenue in Neptune Township, and for the treatment facility. These alarms are intended to provide notification in instances of high water, power failure, and breakdown. All alarms go to the operators' panel including those sounding at the Laird Avenue pump station. The panel and plant are physically inspected every hour, 24 hours a day.

The plant has three treatment trains in constant operation. Each treatment train has primary and secondary settling tanks and trickling filters. This allows influent to be rerouted between treatment trains during maintenance of the facility. There are also duplicate chlorine tanks and sludge digesters, which translates to smoother maintenance and repair processes.

Disinfection is achieved through continuous chlorination with sodium hypochlorite. Two 3000-gallon tanks and one, 1000-gallon tank feed sodium hypochlorite, with an average daily rate of 210 gallons.

There is no chlorine alarm system for failure of the chlorination system. There is a leakage alarm, though. Each sodium hypochlorite tank has a calibrated visual indicator to allow metering of the amount of chlorinating agent present in the tanks.

In addition to typical secondary treatment, effluent also goes through an 18 million gallon aerated stabilization pond for three to five days allowing for additional settling. After aeration, effluent is additionally treated through a Biofor (Biological Filtration Oxygenation Reactor) process. The Biofor process, which is very similar to an activated sludge processor, improves BOD and reduces counts for ammonia and total suspended solids with the help of shale particulate.

After treatment in the Biofor, effluent is additionally chlorinated prior to being discharged to the outfall pipe. TNSA has an additional 500-gallon tank available for finalizing effluent chlorination at this operative point of the facility, prior to its discharge to the plants outfall.

Chlorine residual in effluent is monitored with nine grab samples per day. Effluent bacterial testing is performed year round with one sample taken per day at a tap located at the final leg before the discharge flow goes out to the ocean.

Asbury Park Water Pollution Control Facility

This facility is located at 1701 Ocean Ave., Asbury Park, New Jersey. The plant went online in July 1988.

The wastewater entering this facility comes exclusively from Asbury Park. Secondary treatment is provided to treat what should primarily be considered a composition of residential sanitary waste although there is some light industrial input (approximately 1 %) from a local laundry company.

Plant design allows it to treat up to 4.4 million gallons per day and it is located within a single building, providing a plant that is for the most part, housed indoors. Newer ventilation systems

and wet and dry carbon scrubbers aid in odor control. It utilizes 20 rotating biological contactors (four trains of five rotating contactors) with its secondary treatment system, preceded by screening and primary settling.

There are no pump stations connected to this treatment facility as all wastewater flows by gravity from Asbury Park. It has been estimated that an additional 25 per cent increase over normal flow from sewer lines can occur due to inflow and infiltration from older infrastructure.

Older, damaged lines are a factor in many shore areas. As such, many sewage treatment facilities along the New Jersey shore receive increased influent due to stormwater infiltration and seepage.

Despite the large amount of inflow and infiltration, the average flows for the Asbury Park plant are generally less than design flow and treatment efficiency is considered quite acceptable. There have been no plans addressed that would correct inflow and infiltration problems to date. Funding for such improvement projects has been limited.

The treatment facility has automatic alarm systems for all parameters of operation including its chlorinating system. Alarms will go to the operators' panel and to an alarm service. This facility is not staffed 24 hours per day and when an alarm occurs after hours, an alarm service receives the alarm and contacts the operator of the treatment facility.

Disinfection for this plant is achieved through a continuous manual feed of sodium hypochlorite. Six – 500 gallon tanks are available to provide sodium hypochlorite (only one is used at a given time), with an average daily feed rate of 70 gallons per day during both the summer and winter months.

Chlorine residual is monitored with two grab samples per day. Effluent bacterial testing is performed year round with one sample per week.

Township of Ocean Sewerage Authority

The Township of Ocean Sewerage Authority is located at 224 Roosevelt Avenue in the Oakhurst section of Ocean Township, New Jersey. It was built in 1968. Today, TOSA receives influent from 145 miles of sanitary sewer pipes.

The wastewater feeding into this facility comes from the communities of Ocean Township, Interlaken, Loch Arbor, Allenhurst, Deal and Tinton Falls.

The plant utilizes a pure oxygen-activated sludge system to provide secondary treatment. TOSA influent wastewater is primarily composed of sanitary waste, and the plant is currently designed to treat 7.5 million gallons per day (MGD).

There are eleven pump stations connected to this facility. Pump stations for TOSA have automatic alarms for high water and power failure. Of the eleven stations, eight are located in Ocean Township. The Ocean Twp. stations are located on Norwood Avenue, Wrickapecko Drive, Larchwood Avenue, Asbury Avenue, Lakeview Street and three stations are situated on Green Grove Road. Another pump station can be found on Main Street in Interlaken Boro. The

remaining two pump stations are located in the housing developments of Rolling Meadows and Cedar Village, which both border on Tinton Falls.

The facility runs on six permanent generators. They also have one portable generator in the event an offsite power failure requires immediate start up assistance.

In the case of an alarm situation, the operators' panel in the treatment facility is notified but the Township of Ocean Police Station is also put on alert, as the treatment facility is not staffed 24 hours per day.

After normal working hours, alarms are received by the police, which contact the licensed operator. The treatment facility also has automatic alarms, which are routed in the same fashion and pick up malfunctions at any and all pump stations.

TOSA utilizes a product called Bioxide at six of its pump stations. The use of Bioxide (a Calcium Nitrate derivative) is intended to reduce corrosion and aid in odor control. Corrosion can contribute to frequent replacement part turnover, resulting in higher costs for treatment facilities.

This authority utilizes a Unox system for aeration of the activated sludge tank. Unox systems filter atmospheric air to concentrate the air utilized in aeration to around 90 to 95 percent oxygen. Atmospheric air contains approximately 20 percent oxygen, with the remaining constituents of air consisting primarily of nitrogen and various trace gases. While concentrating oxygen for aeration of the activated sludge tank, the Unox system releases the non-utilized nitrogen and trace gases back to the atmosphere.

Aside from the Unox system utilized for aeration, the plant has a grit system with a heated grit building, four primary settling tanks, activated sludge and secondary settling tank, along with a chlorine contact tank. The activated sludge tank is fully enclosed to take advantage of the enriched oxygen atmosphere provided by the Unox system.

There are duplicate treatment processes so that treatment will not be disrupted when maintenance or repairs are required. The plant also has two sludge holding tanks, and one sludge thickener.

Although the sludge thickener does not have a duplicate, sludge can be fed directly into the sludge holding tanks, bypassing the sludge thickener.

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. The plant has two – 1750 gallon tanks containing sodium hypochlorite. Average daily feed rates equate to 140 gallons per day during the summer and 90 gallons per day in the winter.

There are alarms for low chlorine residual, malfunction of the chlorinator, recorder, and chlorine container depletion at this facility. Chlorine residual is monitored with three grab samples per day. Effluent bacterial testing is performed year round with two samples per week.

Long Branch Sewerage Authority

The Long Branch Sewerage Authority (LBSA) is located at 150 Joline Avenue in Long Branch, New Jersey. The plant went online in 1968. It is an activated sludge treatment facility.

Secondary treatment is provided for wastewater, which is primarily composed of sanitary wastewater with some light industrial input (approximately 1 %) from two laundry companies and a hospital. Wastewater entering this facility comes from approximately 500,000 feet of sewer line connected to 31,000 customers in Long Branch and parts of West Long Branch (i.e. Monmouth University).

The plant is designed to treat 5.4 million gallons per day (MGD). Treatment is typical of an activated sludge, secondary treatment system, preceded by screening and primary settling.

There are seven pump stations connected to LBSA. They are all located in Long Branch, New Jersey. These stations can be found on the following streets: Joline Avenue, Lincoln Gardens, Exchange Place, McClellen Place, Monmouth Place, Hoey Ave. and Willow Ave..

Online, automatic alarms are utilized for the pump stations to register problems with high water, power failure, and breakdown of equipment. The treatment facility interacts with a similar online system for problem notification. In such cases, an alarm goes to the operator's panel in the treatment facility and to an alarm service, which will call the plant operator if an incident occurs after routine daily operational hours.

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. Two, 1550-gallon tanks provide sodium hypochlorite with an average daily rate of 70 gallons per day (summer), and 25 gallons per day in the winter.

The chlorine container is checked daily for depletion. Chlorine residual is monitored with three grab samples per day. Effluent bacterial testing is performed year round with two samples per week.

Two Rivers Water Reclamation Authority

The Two Rivers Water Reclamation Authority (TRWRA) is located at One Highland Ave., Monmouth Beach, NJ. Treatment plant collection and operations began in 1971.

With approximately 200 miles of sewer mains, this facility serves approximately 90,000 customers from 39,000 households in Fair Haven, Little Silver, Oceanport, Shrewsbury Boro, West Long Branch, Monmouth Beach, Tinton Falls, Red Bank, Eatontown, Rumson, Sea Bright, Shrewsbury Township and Fort Monmouth.

TRWRA is a Secondary, Activated Sludge Plant producing secondary treated effluent. The TRWRA facility was designed to handle average flows of 13.83 MGD. According to plant personnel, maximum peak capacity for this plant at any given time is 17.29 MGD.

A gravity and belt filter press thickens sludge. Thickened sludge is trucked offsite for either incineration (available at several sites) or composting which is available at one site.

The facility is staffed 24 hours a day and is equipped with 18 pump stations. Alarm systems are in place should a malfunction or breakdown occur. Automatic alarms are on line for high water, power failure, and breakdown. In the event of an automatic alarm, plant staff are notified via SCADA or Supervisory Control and Data Acquisition.

Essential equipment has backup equipment in the event of breakdown or needs arise for scheduled maintenance. For instance, pumping stations utilize dual pumps and standby generators are also available for emergency use along with two portable generators. Plant personnel are trained to rectify possible malfunctions and equipment failures that might occur within the system. This training is updated on a routine basis and is kept technologically current.

In its operations, the plant uses Sodium Hypochlorite for chlorination and chlorination is continuous and has never been interrupted. The plant currently uses three, 2,400 gallon tanks for chlorination.

Chlorine residual is recorded six times per day. Bacterial Testing is performed eight times per month.

SPILLS, UNPERMITTED DISCHARGES, AND CLOSURES

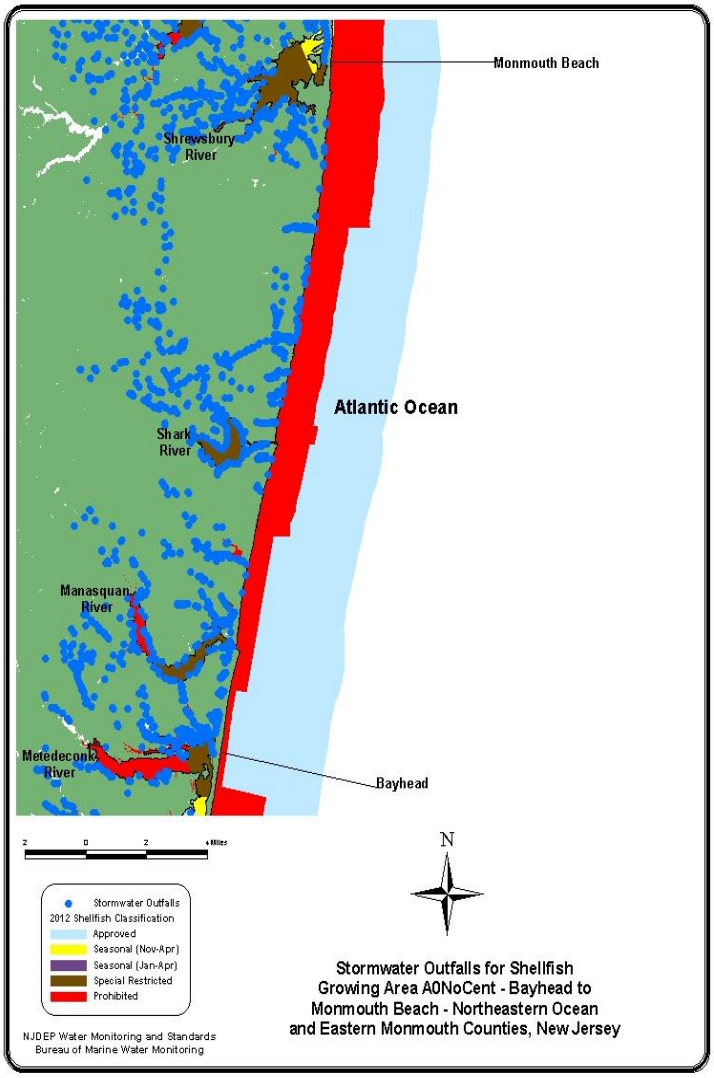
With the exception of Hurricane's Irene and Sandy, which temporarily brought about the closure of all State shellfish growing waters as a precaution for public health and safety, there have been no spills or unpermitted discharges that resulted in the closure of waters in shellfish growing area A0NorthCent.

Leaks or spills that do take place within New Jersey's shellfish growing waters are often the result of a variety of circumstances such as boats sinking, issues with sewage treatment plants such as pump station failure, broken sewer lines, sewer line back up, manhole overflow, broken pipes in commercial or residential locations, improper run off from commercial or residential locations, construction, and road runoff.

Often, the spills or unpermitted discharges noted above have limited impact on the chemical or bacteriological water quality in a shellfish growing area like A0NorthCent. Generally, the spills and discharges are rather small, and their distance to these shellfish growing waters is such that impact is reduced from dilution, percolation, and absorption. From the perspective of this report, which is generally founded on bacteriological results for fecal coliform, WM&S/BMWM station data for A0NorthCent continue to show relatively good water quality. Again, no specific spill or discharge brought about the closure of shellfish growing waters for A0NorthCent during this reporting period.

STORMWATER DISCHARGES

Environmental pressures on shellfish beds in New Jersey can originate in materials that enter growing waters via stormwater. These materials include bacteria, as well as other waste that enters the stormwater collection system. Management of stormwater runoff along this section of coastline (adjacent to A0NorthCent) consists of directing flow into rivers, brooks, lakes, ponds, and in some cases, the front ocean waters through beachfront outfalls. The stormwater outfalls that eventually have their input dispersed into the waters of this shellfish growing area can be seen in the map to the right.

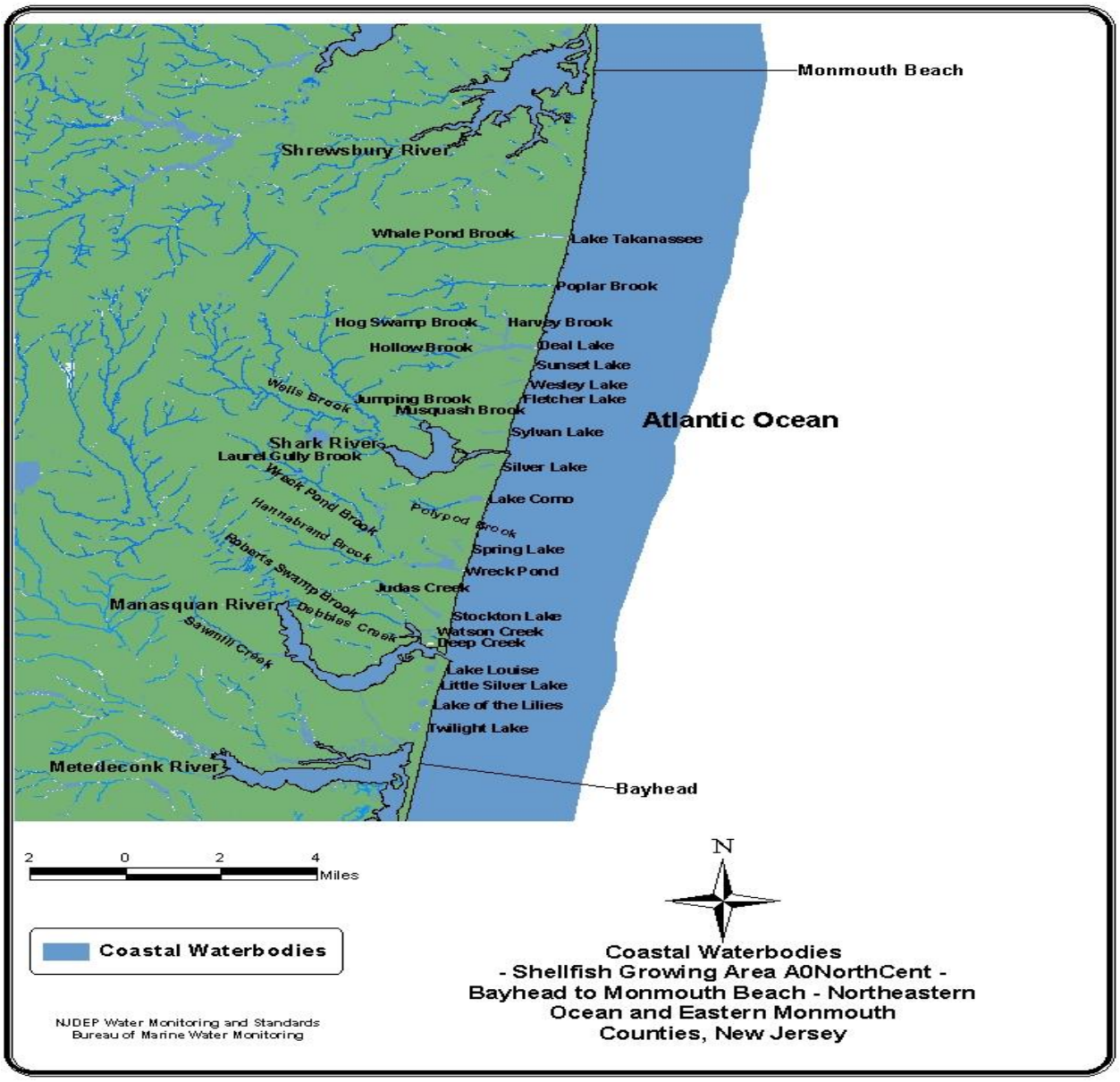


As suggested in the section on Landuse, a review of the stormwater discharge locations for A0NorthCent was conducted in the shoreline survey that took place on 04/11/13. Stormwater outfall locations were for the most part, clear of debris with little surrounding debris, and they were functional, showing little damage had occurred during hurricane Sandy. And, if damage had occurred, it appeared repairs had been made or were being made.

Past and present shoreline surveys of the abutting coastline and nearby communities for this shellfish growing area have provided evidence of a variety of ways that storm runoff enters the ocean waters of A0NorthCent.

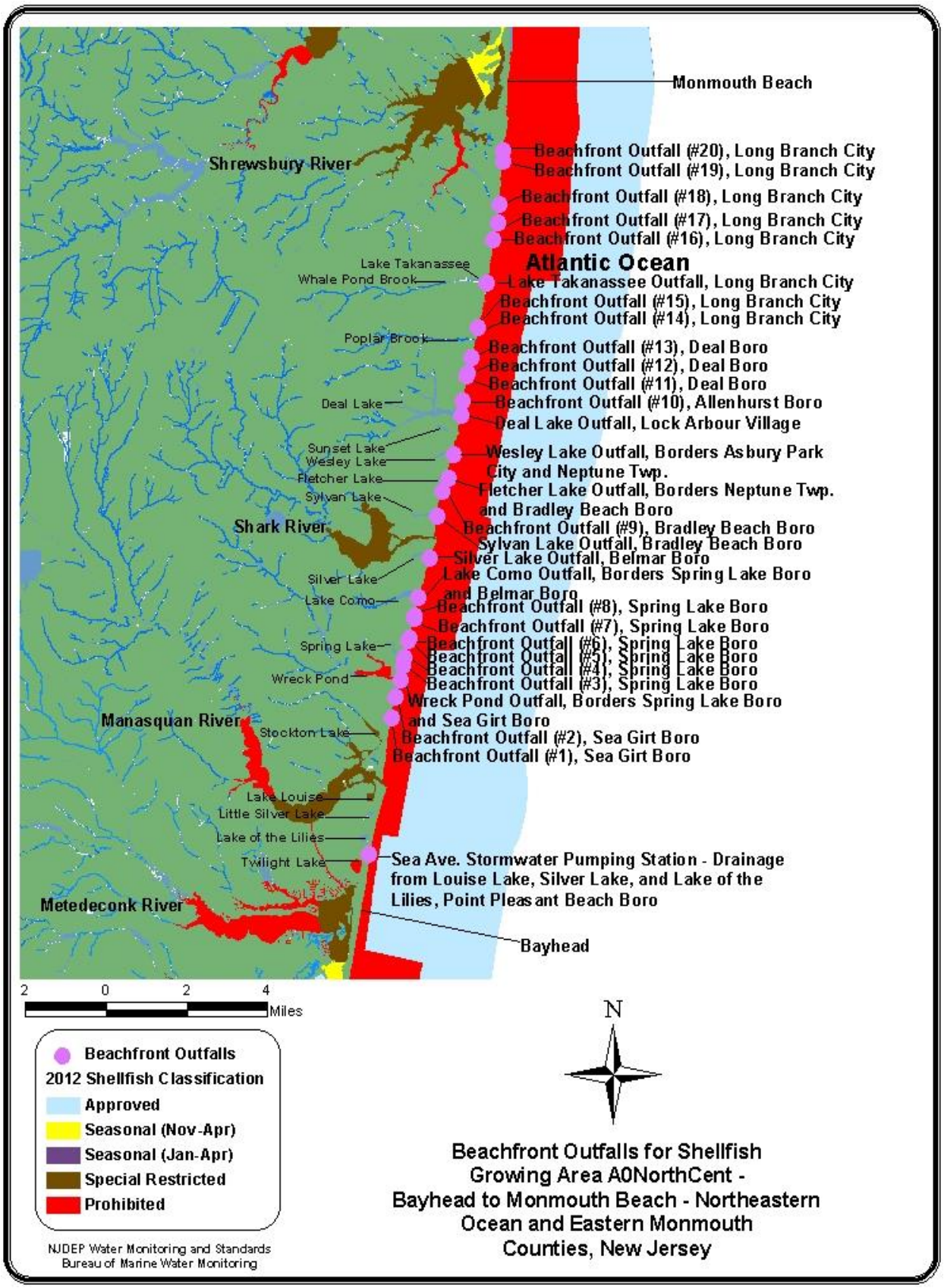
Stormwater runoff delivered to these shellfish growing waters is derived from what can be summarized as three different types of interactions. One of these interactions involves the numerous stormwater inputs received by Manasquan River, Shark River, Poplar Brook, and Whale Pond Brook, which flow into A0NorthCent. Secondly, there is the ocean drainage infrastructure of 12 lakes/ponds (noted as 10 lakes/ponds in previous reports - Lake Como and Silver Lake were identified as having drainage to the ocean during the previous shoreline survey). Stormwater enters these lakes/ponds from runoff or through various site specific outfalls, and eventually these waters flow into the ocean through nine specifically designed drainage systems (changed from seven to nine after previous shoreline survey). The locations of

the rivers, brooks, lakes and ponds that deliver stormwater runoff into A0NorthCent can be seen in the map that follows.



The third source for stormwater inputs into this shellfish growing area involves 20 beachfront outfalls (prior to previous shoreline survey, reports showed this number as eight) that receive unknown input or runoff and then drain into the waters of A0NorthCent.

The ponds/lakes and any of their associated beachfront outfalls along with other non-associated stormwater or indirect beachfront outfalls can be seen in the map on the next page, and their specific locations can be reviewed in the tables that follow that map. Beachfront outfalls that are derived from lakes/ponds (nine outfalls) are highlighted in blue, and the additional outfalls (1 - 20) are highlighted in yellow in those tables.


Monmouth Beach
Shrewsbury River
Beachfront Outfall (#20), Long Branch City
Beachfront Outfall (#19), Long Branch City
Beachfront Outfall (#18), Long Branch City
Beachfront Outfall (#17), Long Branch City
Beachfront Outfall (#16), Long Branch City
Atlantic Ocean
Lake Takanassee
Whale Pond Brook
Lake Takanassee Outfall, Long Branch City
Beachfront Outfall (#15), Long Branch City
Beachfront Outfall (#14), Long Branch City
Poplar Brook
Beachfront Outfall (#13), Deal Boro
Beachfront Outfall (#12), Deal Boro
Beachfront Outfall (#11), Deal Boro
Deal Lake
Beachfront Outfall (#10), Allenhurst Boro
Deal Lake Outfall, Lock Arbour Village
Sunset Lake
Wesley Lake
Wesley Lake Outfall, Borders Asbury Park City and Neptune Twp.
Fletcher Lake
Fletcher Lake Outfall, Borders Neptune Twp. and Bradley Beach Boro
Sylvan Lake
Shark River
Beachfront Outfall (#9), Bradley Beach Boro
Sylvan Lake Outfall, Bradley Beach Boro
Silver Lake Outfall, Belmar Boro
Silver Lake
Lake Como Outfall, Borders Spring Lake Boro and Belmar Boro
Lake Como
Beachfront Outfall (#8), Spring Lake Boro
Beachfront Outfall (#7), Spring Lake Boro
Spring Lake
Beachfront Outfall (#6), Spring Lake Boro
Beachfront Outfall (#5), Spring Lake Boro
Beachfront Outfall (#4), Spring Lake Boro
Wreck Pond
Beachfront Outfall (#3), Spring Lake Boro
Wreck Pond Outfall, Borders Spring Lake Boro and Sea Girt Boro
Manasquan River
Stockton Lake
Beachfront Outfall (#2), Sea Girt Boro
Beachfront Outfall (#1), Sea Girt Boro
Lake Louise
Little Silver Lake
Lake of the Lilies
Twilight Lake
Sea Ave. Stormwater Pumping Station - Drainage from Louise Lake, Silver Lake, and Lake of the Lilies, Point Pleasant Beach Boro
Metedeconk River
Bayhead
2 0 2 4
Miles
N
Beachfront Outfalls
2012 Shellfish Classification
Approved
Seasonal (Nov-Apr)
Seasonal (Jan-Apr)
Special Restricted
Prohibited
NJDEP Water Monitoring and Standards
Bureau of Marine Water Monitoring
Beachfront Outfalls for Shellfish Growing Area A0NorthCent - Bayhead to Monmouth Beach - Northeastern Ocean and Eastern Monmouth Counties, New Jersey

MAP KEY FOR PREVIOUS PAGE SHOWING LOCATION, LATITUDE, AND LONGITUDE FOR BEACHFRONT OUTFALLS IN SHELLFISH GROWING AREA A0NORTHCENT			
Beachfront Outfalls	**Location of Outfall**	**Latitude of Outfall**	**Longitude of Outfall**
Sea Ave. Stormwater Pumping Station for Lake of the Lilies, Little Silver Lake, and Lake Louise	Within 200' of intersection of Beacon and Maryland Avenues, Point Pleasant Beach Boro, Ocean County, NJ	Lat. = N 40° 04' 39.30"	Long. = W - 74° 02' 25.80"
Outfall # 1	East of intersection of Ocean Ave. and Neptune Ave., Sea Girt Boro, Monmouth County, NJ	Lat. = N 40° 07' 29.76"	Long. = W - 74° 01' 46.80"
Outfall # 2	East of intersection of Ocean Ave. and Baltimore Blvd., Sea Girt Boro, Monmouth County, NJ	Lat. = N 40° 07' 55.68"	Long. = W - 74° 01' 38.40"
Wreck Pond - Spring Lake Outfall	Within 200' of intersection of Ocean and Brown Avenues, Bordering Sea Girt Boro and Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 08' 17.50"	Long. = W - 74° 01' 31.30"
Outfall # 3	Due east of bathing house located between Salem and Atlantic Avenue(s) Intersection w/ Ocean Ave., Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 08' 35.94"	Long. = W - 74° 01' 25.98"
Outfall # 4	East of Essex Ave. and Ocean Ave. intersection, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 08' 45.78"	Long. = W - 74° 01' 23.40"
Outfall # 5	East of Jersey Ave. and Ocean Ave. intersection, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 09' 7.32"	Long. = W - 74° 01' 16.56"
Outfall # 6	East of Jersey and Washington Avenue(s) intersection w/ Ocean Ave., Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 09' 9.30"	Long. = W - 74° 01' 15.60"
Outfall # 7	Due east of bathing house located at Ocean and Ludlow Avenues, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 09' 33.90"	Long. = W - 74° 01' 06.90"
Outfall # 8	Due east of Worthington and Ocean Avenues, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 09' 37.20"	Long. = W - 74° 01' 05.90"
Lake Como Outfall	Due east of N. Blvd. and Ocean Avenue, Spring Lake and Belmar Boroughs, Monmouth County, NJ	Lat. = N 40° 10' 0.12"	Long. = W - 74° 00' 59.04"
Silver Lake Outfall	Due east of 6th Ave. and Ocean Avenue, Belmar Boro, Monmouth County, NJ	Lat. = N 40° 11' 43.02"	Long. = W - 74° 00' 39.54"
Sylvan Lake Outfall	East of Evergreen Ave. in Bradley Beach Boro, Monmouth County, NJ	Lat. = N 40° 11' 43.02"	Long. = W - 74° 00' 26.76"
Outfall # 9	East of Ocean Park Ave. and Ocean Ave. intersection, Bradley Beach Boro, Monmouth County, NJ	Lat. = N 40° 12' 13.50"	Long. = W - 74° 00' 18.18"
Fletcher Lake Outfall	Due east of intersection of Ocean Avenue and Broadway, bordering Neptune Twp. and Bradley Beach Boro, Monmouth County, NJ	Lat. = N 40° 12' 29.70"	Long. = W - 74° 00' 11.20"
Wesley Lake Outfall	Near Ocean and Spray Avenues and northeast of the Ocean Pavilion Family Restaurant, bordering Asbury Park City and Neptune Twp., Monmouth County, NJ	Lat. = N 40° 13' 00.10"	Long. = W - 73° 59' 59.30"
Deal Lake Outfall	Due east of Deal Lake and just off Ocean Place and Edgemont Dr., Lock Arbour Village, Monmouth County, NJ	Lat. = N 40° 13' 49.30"	Long. = W - 73° 59' 46.00"

MAP KEY CONT.: LOCATION, LATITUDE, AND LONGITUDE FOR BEACHFRONT OUTFALLS IN SHELLFISH GROWING AREA A0NORTHCENT			
Outfall # 10	Due east of intersection of Ocean Place and Corlies Avenue and east of the Allenhurst Beach Club, Allenhurst Boro, Monmouth County, NJ	Lat. = N 40° 14' 06.60"	Long. = W - 73° 59' 43.90"
Outfall # 11	East of Deal Esplanade and Ocean Ave. intersection, Deal Boro, Monmouth County, NJ	Lat. = N 40° 14' 37.38"	Long. = W - 73° 59' 36.24"
Outfall # 12	East of Darlington Rd. and Ocean Ave. intersection, Deal Boro, Monmouth County, NJ	Lat. = N 40° 14' 41.10"	Long. = W - 73° 59' 34.80"
Outfall # 13	Due east of bathing house located between Parker and Brighton Avenue(s) intersection w/ Ocean Ave., Deal Boro, Monmouth County, NJ	Lat. = N 40° 15' 0.30"	Long. = W - 73° 59' 27.84"
Outfall # 14	Northeast of Beringer Rd. and Ocean Ave. intersection, Long Branch City, Monmouth County, NJ	Lat. = N 40° 15' 38.28"	Long. = W - 73° 59' 17.58"
Outfall # 15	Due east of bathing house located between Beringer Rd. and Lawrence Avenue(s) intersection w/ Ocean Ave., Long Branch City, Monmouth County, NJ	Lat. = N 40° 15' 38.28"	Long. = W - 73° 59' 16.92"
Whale Pond Brook - Lake Takanassee Outfall	Near the intersection of North Lake Dr. and Ocean Avenue and due east of Takanassee Beach Club and Lake Takanassee in the town of Elberon, Long Branch City, Monmouth County, NJ	Lat. = N 40° 16' 33.80"	Long. = W - 73° 59' 00.70"
Outfall # 16	Due east of Sea Verge Apts. and southeast of N. Bath Ave. and Ocean Blvd., Long Branch City, Monmouth County, NJ	Lat. = N 40° 17' 29.00"	Long. = W - 73° 58' 49.30"
Outfall # 17	East of Pavilion Ave. and Ocean Ave. intersection, Long Branch City, Monmouth County, NJ	Lat. = N 40° 17' 48.84"	Long. = W - 73° 58' 41.88"
Outfall # 18	East of Laird St. and Ocean Ave. intersection, Long Branch City, Monmouth County, NJ	Lat. = N 40° 18' 13.20"	Long. = W - 73° 58' 39.06"
Outfall # 19	Due east of Sutton Place Condominium's on Ocean Ave. North, Long Branch City, Monmouth County, NJ	Lat. = N 40° 19' 06.80"	Long. = W - 73° 58' 32.70"
Outfall #20	Due east of Sea Dunes Apts./Condo's on Ocean Ave., Long Branch City, Monmouth County, NJ	Lat. = N 40° 19' 19.60"	Long. = W - 73° 58' 31.30"

From south to north, Manasquan River, Shark River, Poplar Brook, and Whale Pond Brook empty into A0NorthCent directly or indirectly (i.e., Whale Pond Brook indirectly empties into the Atlantic because it feeds into Lake Takanassee which has an outfall that flows into the ocean). The eastward flow of these waterways has potential to adversely influence the water quality in this shellfish growing area. These water systems are capable of receiving substantial quantities of stormwater runoff, and this is highlighted by the number of stormwater outfalls located along their shorelines.

The data contained within this report suggests these waterways did not exhibit significant influence on the shellfish growing water classifications of A0NorthCent during this reporting period, though. It would appear that dilution and mixing of stormwater inputs is occurring within the Manasquan and Shark Rivers along with Poplar Brook and Whale Pond Brook prior to their reaching the waters of this growing area. In addition, the *Prohibited* area utilized along the

shoreline of this growing area provides a substantial buffer. It too acts as an area of additional dilution for indirect inputs before they reach the *Approved* waters of this shellfish growing area.

There are 15 fresh water lakes/ponds located in and along the shore towns of this growing area. From south to north, these lakes/ponds are known as Twilight Lake, Lake of the Lilies, Little Silver Lake, Lake Louise, Stockton Lake, Wreck Pond, Spring Lake, Lake Como, Silver Lake, Sylvan Lake, Fletcher Lake, Wesley Lake, Sunset Lake, Deal Lake, and Lake Takanassee. In addition, there are some smaller unnamed waterbodies, which are further back from the shoreline.

The lakes or ponds mentioned in the previous paragraph are generally less than one mile from the shoreline. With the exception of the nine ocean outfalls that drain the following twelve lakes/ponds: the accumulated waters from Lake of the Lilies, Little Silver Lake, and Lake Louise, which are discharged by the Sea Avenue Stormwater Pumping Station, Wreck Pond, Spring Lake (discharges through Wreck Pond ocean outfall), Lake Como, Silver Lake, Sylvan Lake, Fletcher Lake, Wesley Lake, Deal Lake, and Lake Takanassee, three of the fifteen lakes/ponds were not designed to have direct drainage to the ocean.

The waters contained in the lakes/ponds mentioned in this report tend to receive input from a variety of sources. For example, sections of Wall Township, Spring Lake, Spring Lake Heights, and Sea Girt use Wreck Pond and its tributaries as receiving waters for stormwater runoff. In general, source inputs for these lakes/ponds can include tributaries, stormwater outfalls, waterfowl populations, nutrient loading from manicured lawns, and there is potential for septic runoff from some of the more rural areas of Wall Twp.. Therefore, any interaction with the ocean provided by the 12 lakes/ponds mentioned previously provides potential to impact the waters of A0NorthCent.

In keeping with public health and safety, there are occasions when bathing beaches along the shoreline of this shellfish growing area are closed after rainfall. The Wreck Pond ocean outfall provides a perfect example of a shoreline area where precaution is taken (beaches are closed for 24 hrs. at the end of rain events with > 0.10” of rain or the rain causes an increased flow in storm drains and or closed for 48 hrs. with > 2.8” of rainfall in 24 hrs.) to protect bathers from indirect inputs due to stormwater sources after certain rain events.

Four bathing beaches are involved in these precautionary closures. Those beaches are Brown and York Avenues, just north of the Wreck Pond Outfall, and Terrace and Beacon Blvd. Beaches, which are just south of the Wreck Pond ocean discharge area.

In addition to the nine outfalls that receive inputs from the 12 lakes/ponds noted previously in this section, there are 20 additional Atlantic Ocean beachfront outfalls that have been identified in shoreline surveys performed for this shellfish growing (aside from eight noted in previous reports, an additional 12 were identified in the recent shoreline survey). In total, 29 beachfront outfalls have been identified for this shellfish growing area.

With the possible exception of those outfalls numbered 3, 7, 10, 13 and 15 in the preceding table and map, which seem related to bathhouses or swim clubs, the majority of these outfalls appear to be stormwater related.

From the data, it appears that a good deal of mixing and dilution does take place with the stormwater received by the water systems or infrastructure that feeds this shellfish growing area. The *Prohibited* buffer along the coastline of A0NorthCent certainly aides in providing additional dilution as previously discussed.

The data contained in previous reports along with the statistics presented in this Reappraisal does not indicate routine impact to the ocean waters of this shellfish growing area due to stormwater. When considering stormwater related inputs, the shellfish classifications currently designated appear appropriate with regard to the guidelines promulgated by the National Shellfish Sanitation Program.

WATER QUALITIES STUDIES

SAMPLING STRATEGY

Shellfish growing area A0NorthCent was sampled using the Adverse Pollution Condition (APC) sampling strategy. The APC sampling strategy requires a minimum 15 sample composite of data, collectively supported by a minimum requirement of five samples per year.

Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion to classify its waters. The criteria were developed to ensure that shellfish harvested from designated waters would be free of pathogenic (disease-producing) bacteria. Combinations of these criterion may also be used. While New Jersey had been using fecal coliform analysis (direct 3 tube, A-1) and criteria for its ocean waters and total coliform analysis (3 tube, three dilution) and criteria for its back bay areas, BMWM/WM&S switched all State shellfish growing areas over to the criteria for fecal coliform in February, 2012, and the method for analysis changed as well.

BMWM/WM&S now use mTEC agar plating to facilitate the fecal coliform bacteriological analysis for samples taken within New Jersey shellfish growing areas, and had been acquiring adjunct mTEC data for its growing areas for some time in order to statistically facilitate the transition to mTEC. Statistical facilitation, in the case of Shellfish growing area A0NorthCent refers to the combination of past, 3 tube, A-1 data with current mTEC data in order to obtain statistically valid measurements during the transition.

Each classification criterion is composed of a measure of the statistical "central tendency" (geometric mean) and the relative variability of the data set. For the Adverse Pollution Condition sampling strategy, variability is expressed utilizing the 90^{th} percentile. Although the State has only *Approved* and *Prohibited* classifications in its ocean waters, an area to be *Approved* under the *Seasonal* classification using APC would have to be sampled and meet the criterion during the time of year that it is *Approved* for the harvest of shellfish. The table on the next page shows the statistical criteria for the APC strategy.

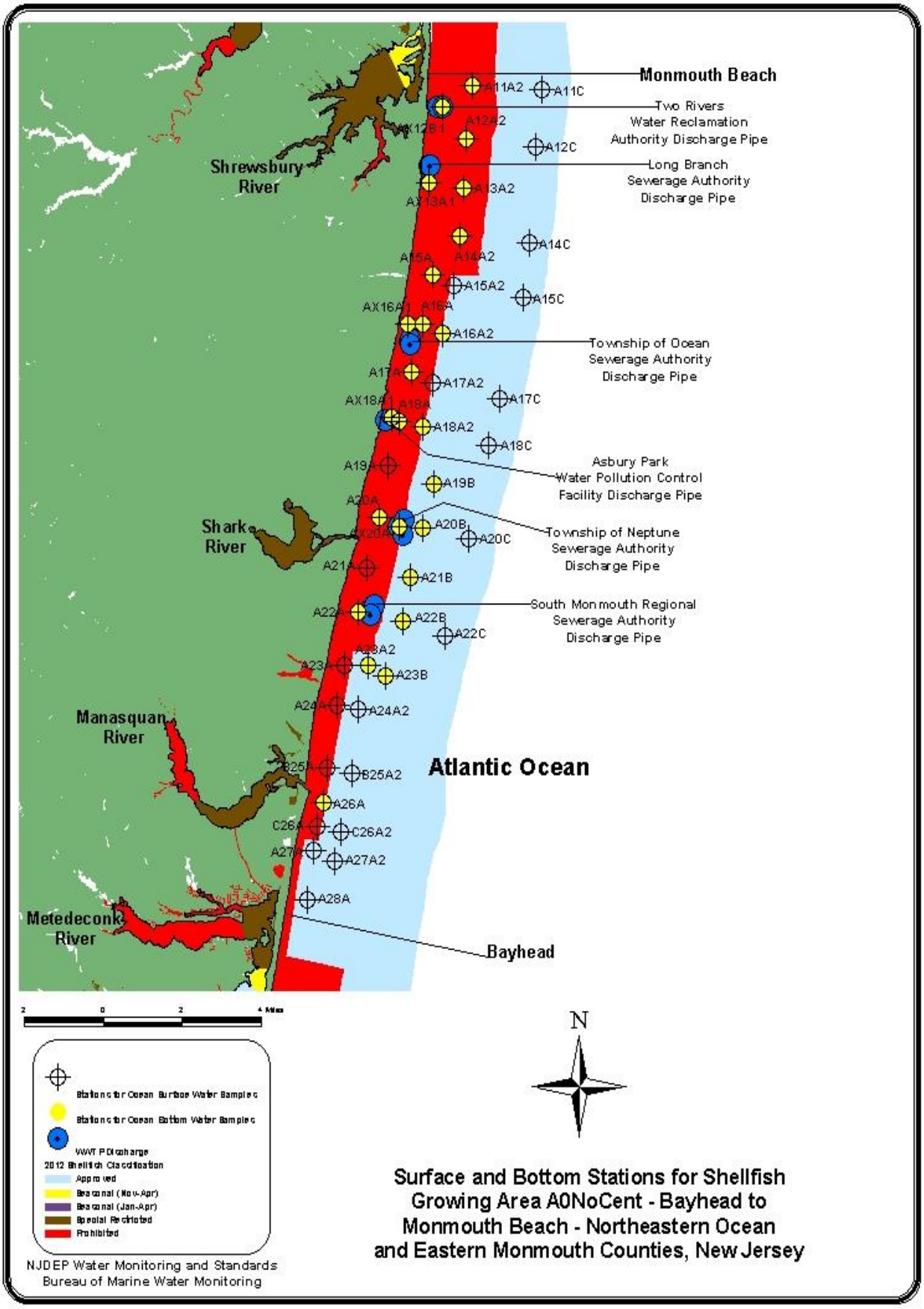
Statistical Criteria for Adverse Pollution Condition Sampling Strategy					
	Total Coliform Criteria		Fecal Coliform Criteria		
	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)	
Approved Water Classification	70	330	14	49 w/ direct 3-tube, A1	31 w/ mTEC Agar
Special Restricted Water Classification	700	3300	88	300 w/direct 3-tube, A1	163 w/ mTEC Agar

Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARCMAP).

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). Water quality sampling, analysis, and shoreline/watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish,* 2009.

The results were compiled from the 46 surface and 24 bottom stations that comprise Assignments 521, and 541. A review of the records suggests that 1,480 water samples were collected for fecal coliform bacterial analysis between 2008 and 2012 and analyzed using mTEC agar plating analysis. Additional information on lab methodology and sampling strategy can be found in the Shellfish Growing Area Report Guidance Document.

The Shellfish Growing Water Monitoring Stations for Bayhead to Monmouth Beach (A0NorthCent) are presented on the next page. They were analyzed by WM&S/BMWM at Leeds Point. Classification of these shellfish growing waters has been based on these data.


Monmouth Beach
A11A2
A11C
Two Rivers
Water Reclamation
Authority Discharge Pipe
A12A2
A12C
Shrewsbury
River
Long Branch
Sewerage Authority
Discharge Pipe
A13A2
A14C
A14A2
A15A2
A15C
A16A2
Township of Ocean
Sewerage Authority
Discharge Pipe
A17A2
A17C
A18A2
A18C
Asbury Park
Water Pollution Control
Facility Discharge Pipe
A19B
Shark
River
A20B
A20C
Township of Neptune
Sewerage Authority
Discharge Pipe
A21B
South Monmouth Regional
Sewerage Authority
Discharge Pipe
A22B
A22C
A23B
A24A2
Manasquan
River
Atlantic Ocean
B25A2
A26A
C26A2
A27A2
A28A
Metedeconk
River
Bayhead
2 0 2 4 Miles
Stations for Ocean Surface Water Samples
Stations for Ocean Bottom Water Samples
WWTP Discharge
2012 Shellfish Classification
Approved
Seasonal (Nov-Apr)
Seasonal (Jan-Apr)
Special Restricted
Prohibited
NJDEP Water Monitoring and Standards
Bureau of Marine Water Monitoring
N
Surface and Bottom Stations for Shellfish
Growing Area A0NoCent - Bayhead to
Monmouth Beach - Northeastern Ocean
and Eastern Monmouth Counties, New Jersey

BACTERIOLOGICAL QUALITY

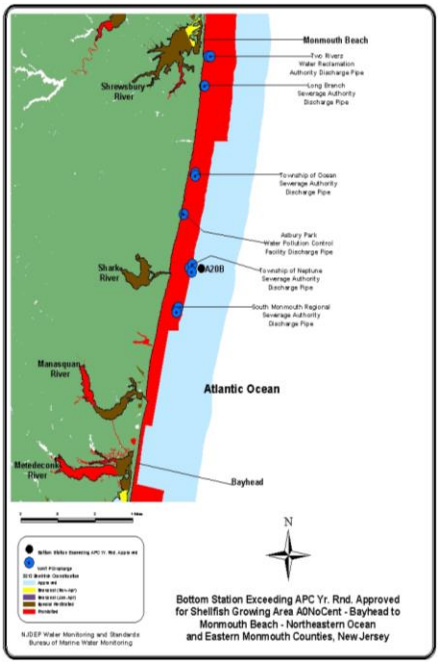
Compliance with NSSP APC Approved Year Round Criteria

Approved bottom station A20B or [A20B (A - B)] exceeded APC *Approved* year round criteria with 27 samples when reviewing the Statistical Summary and the Shellfish Growing Water Data Listings. Its location is presented in the figure at the bottom of the page.

When preparing the data analysis for this growing area, one of the assignments had fewer collected samples over the time frame selected. This meant that one assignment had quite a number of samples during the time frame selected while the other was closer to the required minimum amount of 15 samples for the data pull. This was unavoidable when selecting data for both assignments in order to capture a minimum of 15 samples. However, with regard to the available data, if one were to reduce the sample allocation for A20B (A - B) with a smaller sample analysis approaching 15 for the assignment with more samples collected, A20B (A - B) would still exceed APC year round *Approved* criteria due to the timing when higher sample results occurred in the data.

A combined analysis using fecal coliform direct 3 tube A-1, and mTEC was utilized to analyze the data for this Reappraisal. A20B (A - B) had a year round geo-mean of 4.3 MPN/100 mL, which was acceptable for APC year round *Approved* criteria. *Approved* bottom station A20B exceeded its 90th percentile for *Approved* criteria with 11.1 % > 41 MPN/100 mL, though. The appropriate data analysis for the *Approved* waters of this growing area requires the geometric mean not exceed 14 MPN/100 mL and no more than 10% of the samples should exceed 41 MPN/100 mL with 27 samples. On September 24th and 28th 2009, station A20B (A - B) had single day sampling MPN/100 mL's of 43.0, respectively. On 08/17/11, station A20B (A - B) had a single day MPN/100 mL of 63.0.

As suggested there were three sample dates (09/24/09, 09/28/09 and 08/17/11) where bacteriological results where high enough to cause station A20B (A - B) to exceed NSSP *Approved* year round criteria. All bacteriological counts since 08/17/11 have been very low (i.e., 3.0 k or less than three on each of six sample dates) and within the *Approved* criteria.



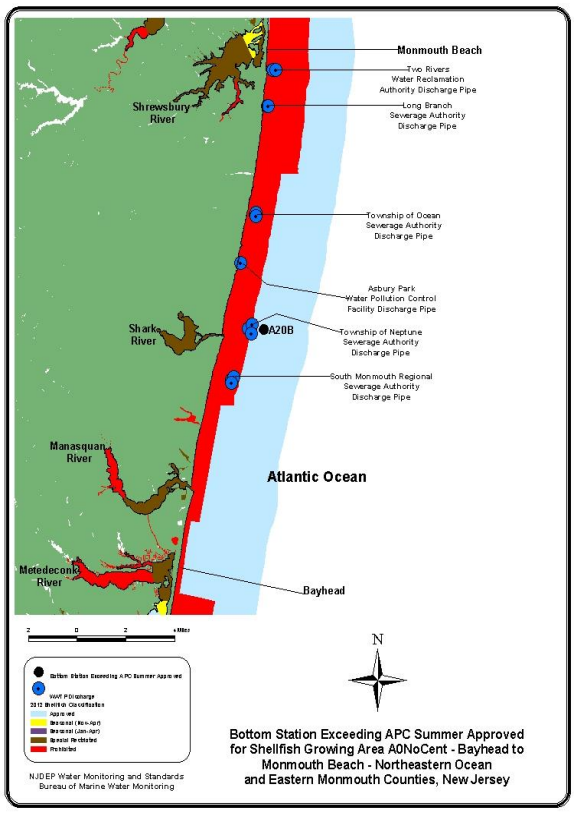
Since 09/28/09, there have been 18 samples taken. Of those 18 samples dates, 16 dates reported 3.0 k, one date had 4.0, and the 08/17/11 sample showed an MPN/100 mL of 63.0. Geometric means were acceptable for station A20B (A - B) but higher bacteriological results on the three dates did cause A20B (A - B) to exceed its 90th percentile. As A20B (A - B) exceeded the criteria for APC *Approved* yr. rnd., it is recommended that station A20B (A - B) monitoring results be routinely reviewed to see if further action is warranted. At this time, it appears from the data that bacteriological results have continued to improve for some time.

Compliance with NSSP APC Approved Criteria During Summer

Approved bottom station A20B (A - B) exceeded APC *Approved* criteria for the summer with 20 samples when reviewing the Statistical Summary. When utilizing a combined analysis of fecal coliform direct 3 tube A-1, and mTEC, this bottom station had a summer geometric mean that was 4.8 MPN/100 mL, which was acceptable for *Approved* criteria. It exceeded the 90th percentile for summer with 15.0 % > 41 MPN/100 mL.

The appropriate data analysis for this shellfish growing area requires the geometric mean not exceed 14 MPN/100 mL and no more than 10% of the samples should exceed 41 MPN/100 mL with 20 or more samples.

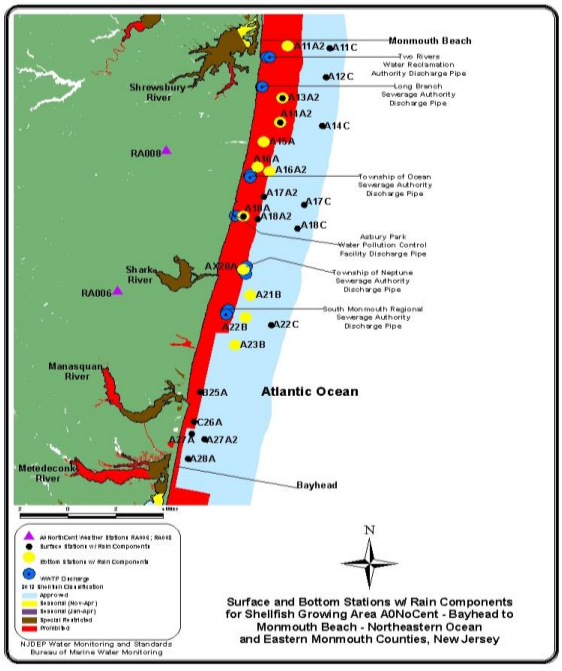
As recommended in the previous section, station A20B (A - B) monitoring results should be routinely reviewed to see if further action is warranted. Data has been improving for this station with regard to routine monitoring for bacteriology [location for A20B (A - B) is shown in figure to the right].



Rainfall Effects

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region. Summer storms are localized and often associated with thunder and lightning activity. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall. Additional information on annual storm averages, duration, intensity, and event volume is provided in the Shellfish Growing Area Report Guidance Document.

With the exception of Hurricane's Irene and Sandy, which occurred on August 26, 2011 and October 29, 2012, respectively, precipitation, accumulation, and the nature of storm events have not changed drastically for this reporting period. However, as pointed out in the section, Spills, Unpermitted Discharges, and Closures, these hurricanes did



bring about the temporary closure of all State shellfish growing waters as a precaution for public health and safety.

The precipitation data for this area was provided by the National Oceanic and Atmospheric Administration (NOAA), and stations RA006 and RA008. Those stations, and stations with wet/dry components, discussed in the paragraphs that follow, are shown in the map at the bottom of the previous page.

Based on Wet/Dry statistics, there were 16 surface sampling stations and 11 bottom stations (27 total) that showed rainfall components in relation to water quality for this shellfish growing area. Sixteen stations were in *Approved* waters and 11 were in *Prohibited* waters. For the *Approved* stations, 11 were surface stations, and five were bottom stations. For the *Prohibited* stations, five were surface stations, and six were bottom stations. These stations were located throughout this shellfish growing area.

Rainfall components must register a t-statistical probability less than 0.05. The Wet/Dry Statistics were calculated based on an impact time of 72 hours prior to the day of sampling and a wet/dry cutoff of 1.00 inch of rain, as these criteria produced the most results for impact. Rain component stations showed a higher geometric mean during wet conditions as opposed to dry. Geometric means for wet conditions in the wet/dry data sheets were within *Approved* criteria for all but eight stations. For those eight stations, geometric means were noted from 15.5 to 36.7 MPN/100 mL. Four of those eight stations were in *Prohibited* waters. No rain component station had more than two wet counts.

In the Statistical Summary, a review of 17 - 27 samples showed the highest year round geometric mean recorded for any one of the 27 stations with rain components was 5.3 MPN/100mL. And, 90th percentiles were no higher than 5.9% > 36 MPN/100 mL. All stations with rainfall components were within NSSP criteria for *Approved* waters in the year round summary with 15 or more samples. With this, the water quality in this shellfish growing area report suggests impact from rainfall but no change in classifications are required at this time.

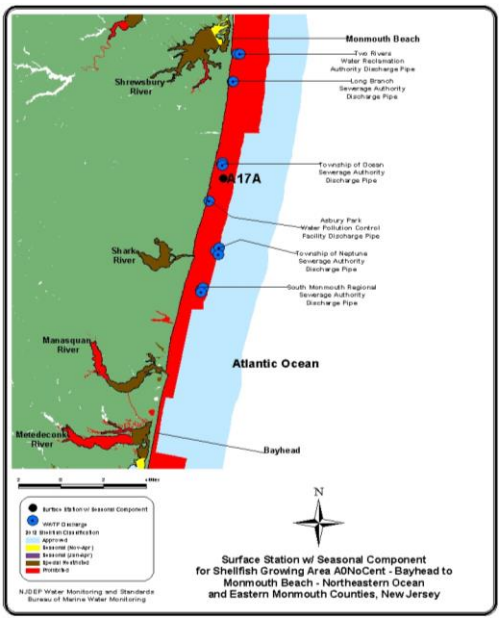
Seasonal Effects

Some of the urban communities in the shore area abutting the waters of A0NorthCent experience seasonal fluctuations in populace. For those towns, which show an increase in population due to summer resort activities, the summer months can result in increased impacts to nearby water sources. This can be due to a number of things such as petroleum wastes from additional car and boat traffic, or other residuals released into the environment from summer’s flexing population, and their activities. However, impacts to State ocean waters are not necessarily isolated as warmer month occurrences. Various circumstances such as storm activity can create impact during the winter.

As this is a populated New Jersey coastal area, bacterial data analyzed by WM&S/BMWM provides support for the specific classifications attributed to portions of the water bodies (i.e., the rivers) that eventually flow into the waters of A0NorthCent. These classifications can encompass

Special Restricted and *Prohibited* designations, because these water sources are prone to receiving various inputs, and have multiple marinas in their waters.

The map to the right shows one station that had a seasonal component with the T-Probability being < 0.05. That station, *Prohibited* surface station A17A (P - S), is situated in the central portion of the growing area.



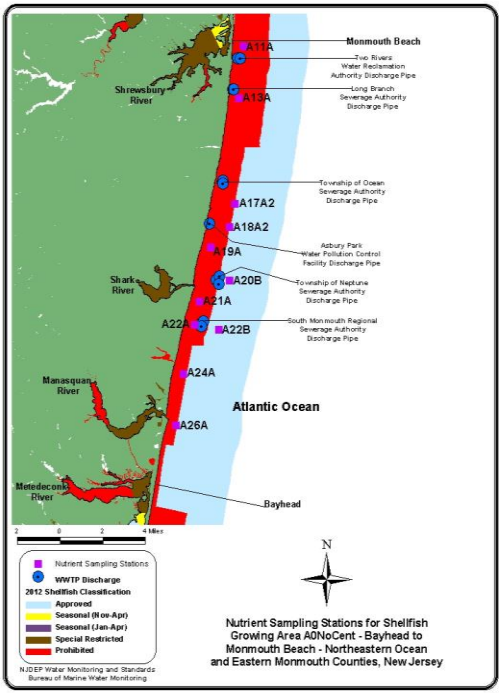
On summary evaluation, station A17A (P - S) was within the criteria for *Approved* water classification regardless of its having a seasonal component. A17A (P - S) had a higher geometric mean during the winter season with 4.6 MPN/100 mL and two samples in the seasonal stats. From the Statistical Summary, the year round geometric mean for this station was 3.2 MPN/100 mL, and its 90th percentile showed 0 % > 44 MPN/100 mL with 19 samples. Minimal impact was noted from seasonality, and no change is required in shellfish classifications.

RELATED STUDIES

Nutrients

WM&S/BMWM perform additional water quality studies related to the bacteriological monitoring program. Nutrient monitoring and the collection of nutrient data as part of the NJ Coastal Monitoring Network is an example of one of those studies.

Nutrient stations are sampled on a quarterly basis. There are approximately 250 nutrient sampling stations within the coastal and inner coastal waters of New Jersey. Twenty-four of those stations are located within the ocean waters off the New Jersey coast. The 226 remaining nutrient stations are spread throughout the States back bay waters. WM&S/BMWM compile the results of nutrient levels from such stations and then prepare a separate report. Shellfish growing area A0NorthCent has eleven nutrient samplings stations as shown in the figure to the right.



Chlorophyll data are also contained within the nutrient data. As such, WM&S'/BMWM is able to maintain a quarterly picture of algal activity within State waters. This chlorophyll data also proves to be useful as adjunct information to the Bureau's phytoplankton monitoring program. Further information on nutrients within State waters is available at www.state.nj.us/dep/wms/bmw in

sections such as those referring to Estuarine and Coastal Water Quality.

Phytoplankton Monitoring

In the WM&S/BMWM phytoplankton monitoring program, data are collected from samples that are gathered bi-weekly from May through August (Memorial Day through Labor Day). The data are evaluated by WM&S/BMWM in order to determine the presence of marine biotoxins in accordance with NSSP requirements. Reports denoted as Summary of Phytoplankton blooms have been compiled and are available electronically at *www.state.nj.us/dep/wms/bmw*.

There are 16 phytoplankton stations within the waters of New Jersey. Of those 16, four are located off the coast from the southerly portion of Sandy Hook down to Cape May. The other 12 phytoplankton stations are situated within New Jersey's back bay waters.

Stations A11A and A24A are phytoplankton stations located in shellfish growing area A0NorthCent (locations for A11A and A24A are shown in figure denoting nutrient sampling stations). Current monitoring (again see *www.state.nj.us/dep/wms/bmw*) suggests that populations of phytoplankton are generally sparse for samples taken at these stations, or they are found in non-bloom concentrations where toxic species are concerned.

Nutrient and phytoplankton stations are generally arranged so samples for both are taken from matching locations. In this regard, data can be uniformly compared and analyzed where those stations occur and overlap.

There are occasional occurrences of algal blooms in all ocean waters in New Jersey, and these can occur throughout the year. The warmer months of spring and summer provide a very common period for algal growth, though.

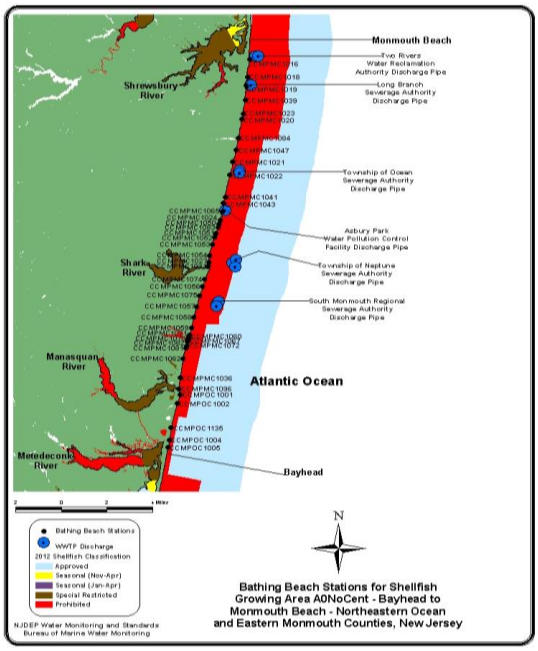
It is more frequently the discoloration of the water from algal blooms that causes issues along New Jersey's coastal waters rather than the toxicity of the phytoplankton. For example, brown tides resulting from one of New Jersey's more frequent algal blooms can be spotted in back bay waters, inlets, and occasionally the ocean, near inlet passageways. This generally occurs during May and June. However, aside from the bloom causing discoloration of the water, there are no known threats to human health from brown tides. For this reason, they are not considered in classifying waters for shellfish harvest.

Cooperative Coastal Monitoring

WM&S/BMWM also oversee the Cooperative Coastal Monitoring Program (CCMP). CCMP involves coastal water quality assessments and pollutant source investigation. There are two components to this program. These are recreational water quality monitoring at New Jersey bathing beaches and aerial surveillance of State coastal waters.

Water quality monitoring for the bathing beach component is administered by NJDEP, the Department of Health and Senior Services and local environmental health agencies interacting within their regions of coastal New Jersey. These agencies collect water samples each week at

175 ocean and 43 bay monitoring stations from mid-May through mid-September. Samples are taken on Monday and continued sampling through the week is performed as required. Samples are analyzed for enterococci bacteria concentrations at these monitored stations.



Enterococci are used as a fecal coliform indicator in marine recreational waters (US EPA, 1986). The acceptable rate for the "steady state geometric mean indicator density" for enterococci in the waters of marine bathing beaches is 35 CFU/100 mL or less, and 104 CFU/100 mL is also considered acceptable as a one time exposure (Cabelli, 1983).

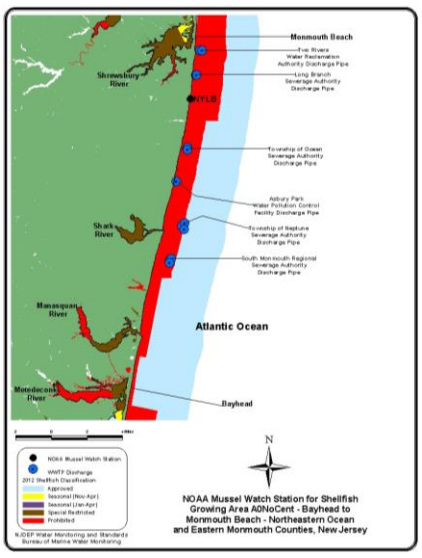
A0NorthCent has 43 bathing beach stations as shown on the map to the right. Data for these stations is available at http://www.njbeaches.org.

The other component of the CCMP program, aerial surveillance, is conducted six days a week, weather permitting. Having this component provides an evaluative tool to aerially observe coastal water quality and potential pollution sources.

Flight paths are coordinated to observe the eastern coastal and inter-coastal waters of the State during the week. The aerial component of the CCMP program works in conjunction with the United States Army Corps of Engineers. It is part of the NY/NJ Harbor Estuary Program Floatables Action Plan. If floating solid waste and debris are spotted by aerial surveillance, the Army Corps attempts to respond with water-skimming vessels.

NOAA Mussel Watch

WM&S/BMWM track projects such as the NOAA Mussel Watch in order to obtain data relating to toxins or metals within specific marine species and ecosystems. A0NorthCent has NOAA Mussel Watch station NYLB within its growing waters. The location of this station can be seen in the figure to the right, and data for this station is available at http://ccma.nos.noaa.gov/about/coast/nsandt/musselwatch.aspx.



CONCLUSIONS

The following was concluded based on the water quality data from May 01, 2008 through October 22, 2012. The shellfish growing waters within this 18 -mile stretch, known as A0NorthCent, generally continue to meet NSSP criteria for classifications.

An exception was presented with *Approved* Bottom station A20B or A20B (A - B) as it exceeded NSSP APC *Approved* year round and summer criteria, which was discussed in the Bacteriological Quality section. Going forward, a routine review of incoming monitoring data has been suggested for this station.

Data review suggests the effluents from outfalls of the South Monmouth Regional Sewerage Authority, Township of Neptune Sewerage Authority, Asbury Park Water Pollution Control Facility, Township of Ocean Sewerage Authority, Long Branch Sewerage Authority, and the Two Rivers Water Reclamation Authority are not impacting the shellfish growing waters of this area with significant coliform levels.

There were no indications that indirect discharges such as spills caused significant impact to the waters of this growing area. There is also the presence of stormwater runoff and indirect and stormwater related discharge from outfalls along the coastal shoreline of A0NorthCent, and within the lakes, ponds, rivers and brooks that feed the growing area. The data additionally suggests that these discharges appear to be limited in impact or reduced with mixing and dilution prior to entering the shellfish growing waters of A0NorthCent.

Prohibited waters in this growing area remain a primary necessity though in order to fulfill requirements for buffers, dilution, public health, and safety in relation to the direct and indirect/stormwater related outfalls or runoff present in these shellfish growing waters.

Although limited in their impact, there were seasonal and rainfall components noted for some stations. In these cases, impact is suggested to have been limited due to the relatively low fecal coliform levels in relation to those components.

Coliform levels were generally too low in the data that supports this report to suggest there is substantial impact or ongoing impact from any of the potential sources mentioned in this section and throughout most of this Reappraisal. The data derived from WM&S/BMWM monitoring projects, supports a predominately good characterization for water quality in A0NorthCent.

RECOMMENDATIONS

With regard to the summarizations presented in this report, there are no changes proposed for A0NorthCent assignments 521 and 541, monitoring stations, sampling strategy (APC) or classifications planned at this time. Continuous data monitoring practices have been specifically recommended for *Approved* bottom station A20B, though.

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USPHS. National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2009. US Public Health Service, Food and Drug Administration, Washington, DC.

SUPPORTING DOCUMENTATION

Data sheets - Reappraisal Report for Shellfish Growing Area A0NorthCent (Bayhead to Monmouth Beach), April 2013 (see the Shellfish Growing Area Reports section at *www.state.nj.us/dep/wms/bmw*).

Shoreline survey field notes and pictures - Reappraisal Report for Shellfish Growing Area A0NorthCent (Bayhead to Monmouth Beach), April 2013 (see the Shellfish Growing Area Reports section at *www.state.nj.us/dep/wms/bmw*).